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**Zohar**

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(54) **IDENTIFYING THE LOCATION OF MOBILE STATIONS**

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***H04W 24/00*** (2009.01)

(52) **U.S. Cl.**
USPC ..... **455/404.1**; 455/456.1

(58) **Field of Classification Search**
USPC ..... 455/456.1, 404.2, 414.1
See application file for complete search history.

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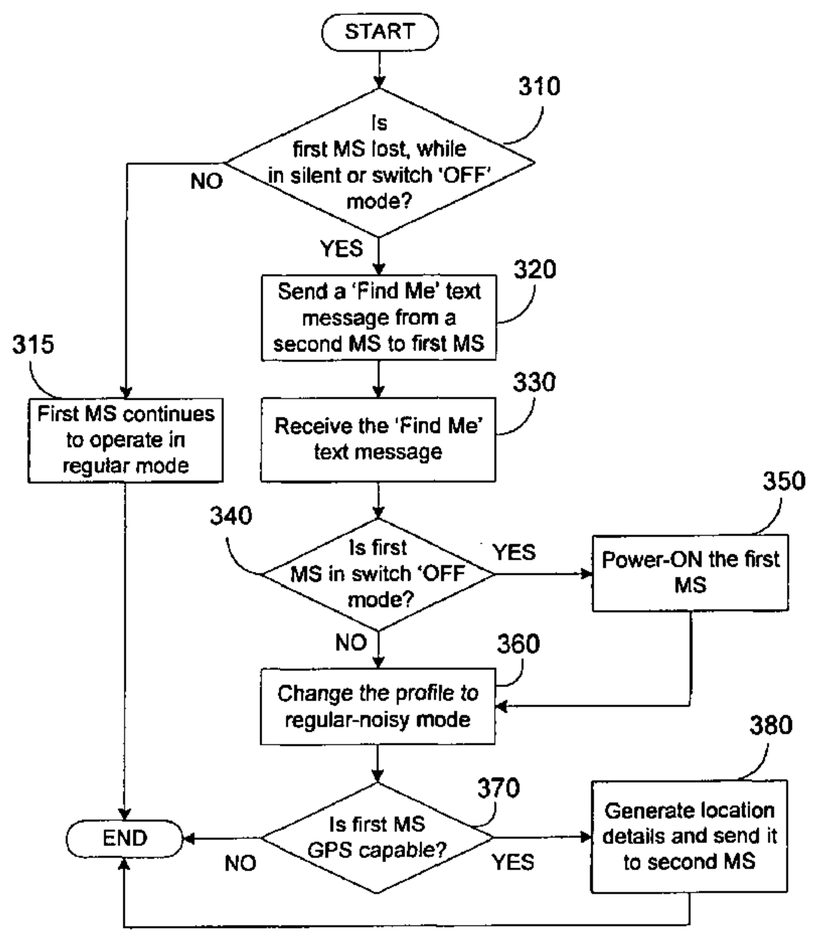
(57) **ABSTRACT**

A user of a first mobile station, which is lost either in silent mode or switch-off mode may send a 'Find-Me' message to the first mobile station from a second mobile station. The first mobile station, after receiving the 'Find-Me' message, may power-on the first mobile station enabling the first mobile station to receive voice call and messages. Also, if the first mobile station is in silent mode, the first mobile station may change the profile of the first mobile station from a silent to a regular-noisy mode. The user of first mobile station may call-up the first mobile station and identifies the location of the first mobile station by tracking the ringing sound. The first mobile station may send a location message to the second mobile station in response to receiving the 'Find-Me' message that may be used to identify the location of the first mobile station.

**22 Claims, 2 Drawing Sheets**



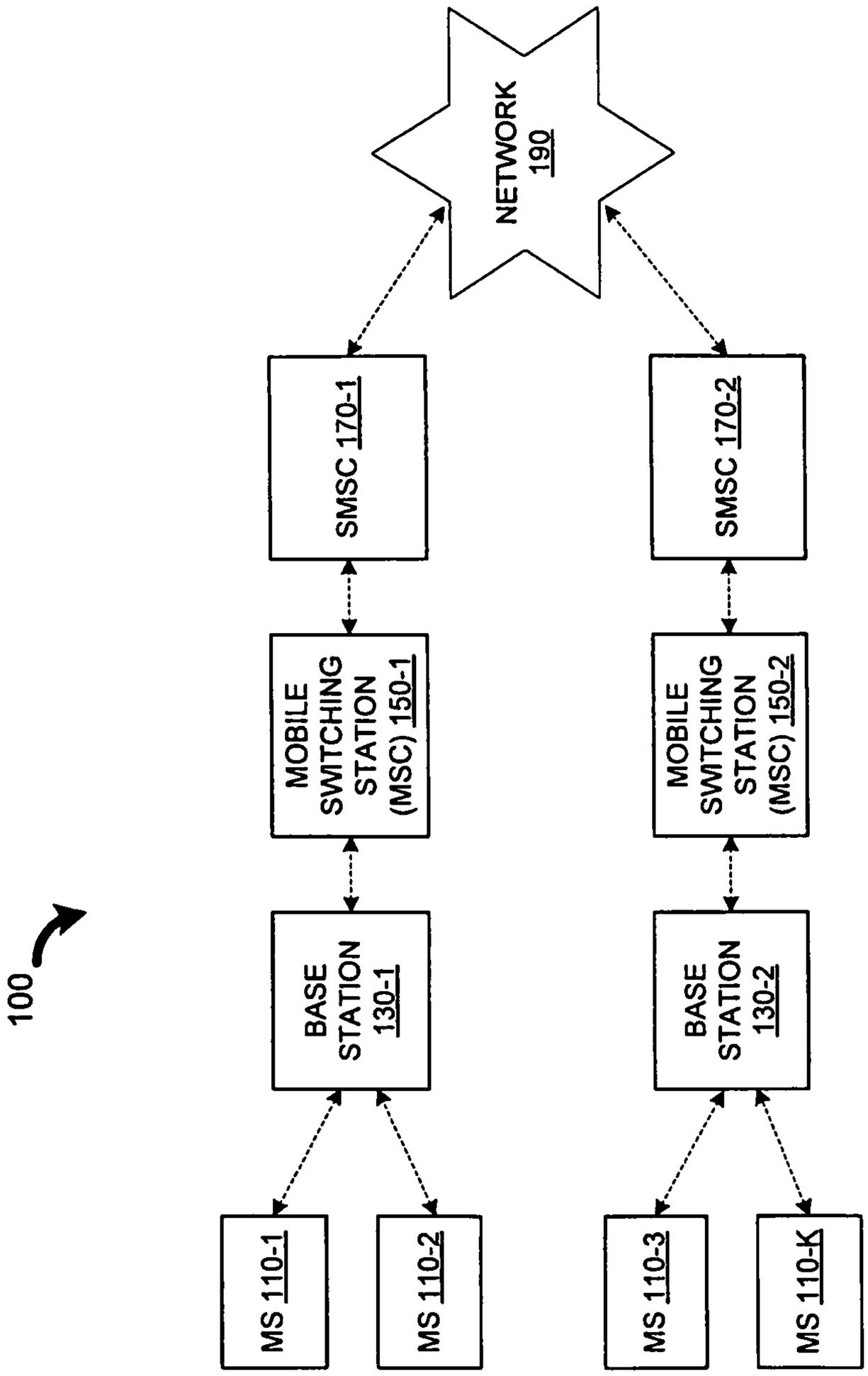

100
NETWORK 190
SMSC 170-1
SMSC 170-2
MOBILE SWITCHING STATION (MSC) 150-1
MOBILE SWITCHING STATION (MSC) 150-2
BASE STATION 130-1
BASE STATION 130-2
MS 110-1
MS 110-2
MS 110-3
MS 110-K

FIG. 1

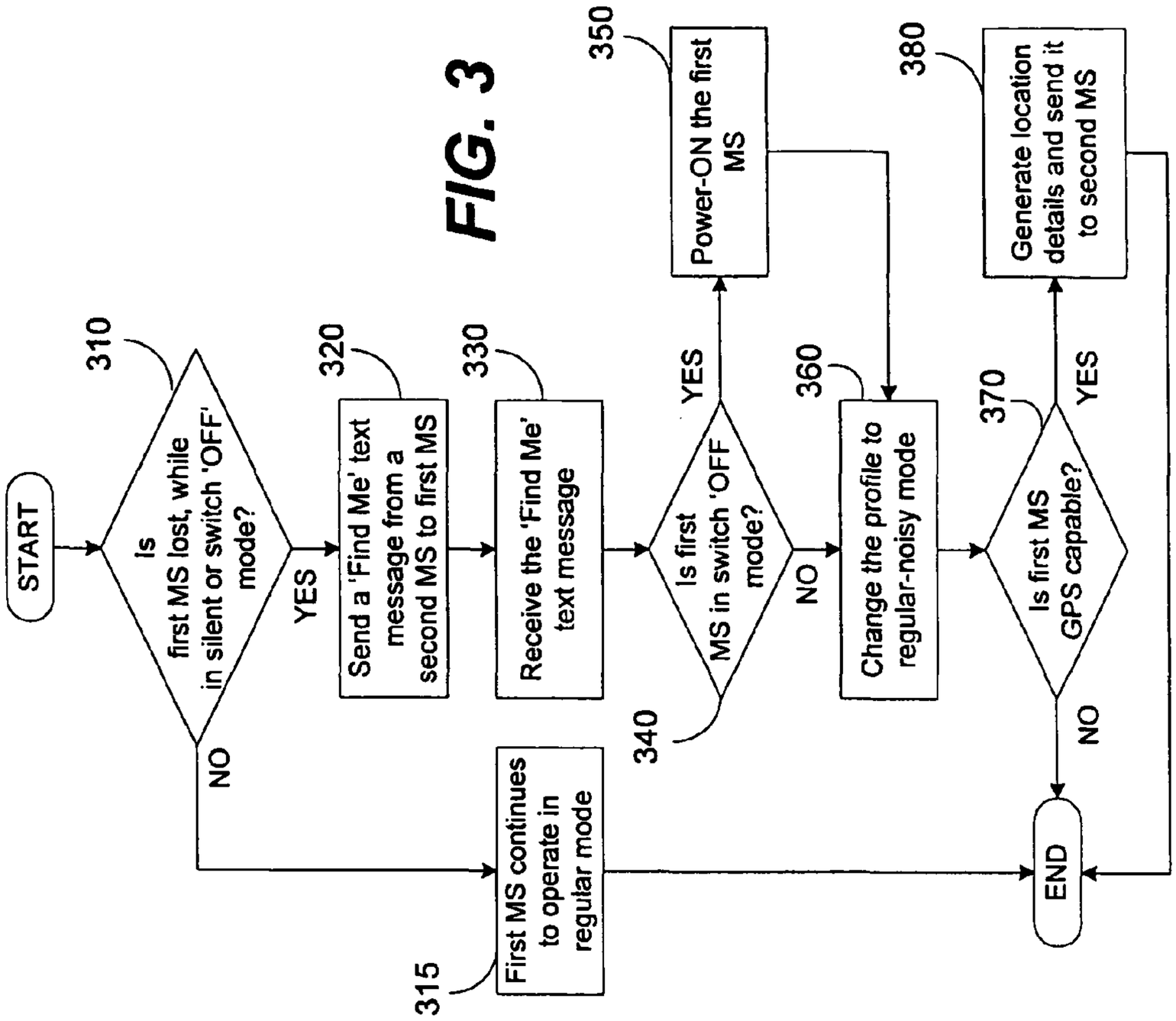

START
Is first MS lost, while in silent or switch 'OFF' mode?
310
YES
NO
Send a 'Find Me' text message from a second MS to first MS
320
Receive the 'Find Me' text message
330
Is first MS in switch 'OFF mode?
340
YES
NO
First MS continues to operate in regular mode
315
Change the profile to regular-noisy mode
360
Is first MS GPS capable?
370
YES
NO
Power-ON the first MS
350
Generate location details and send it to second MS
380
END

FIG. 3

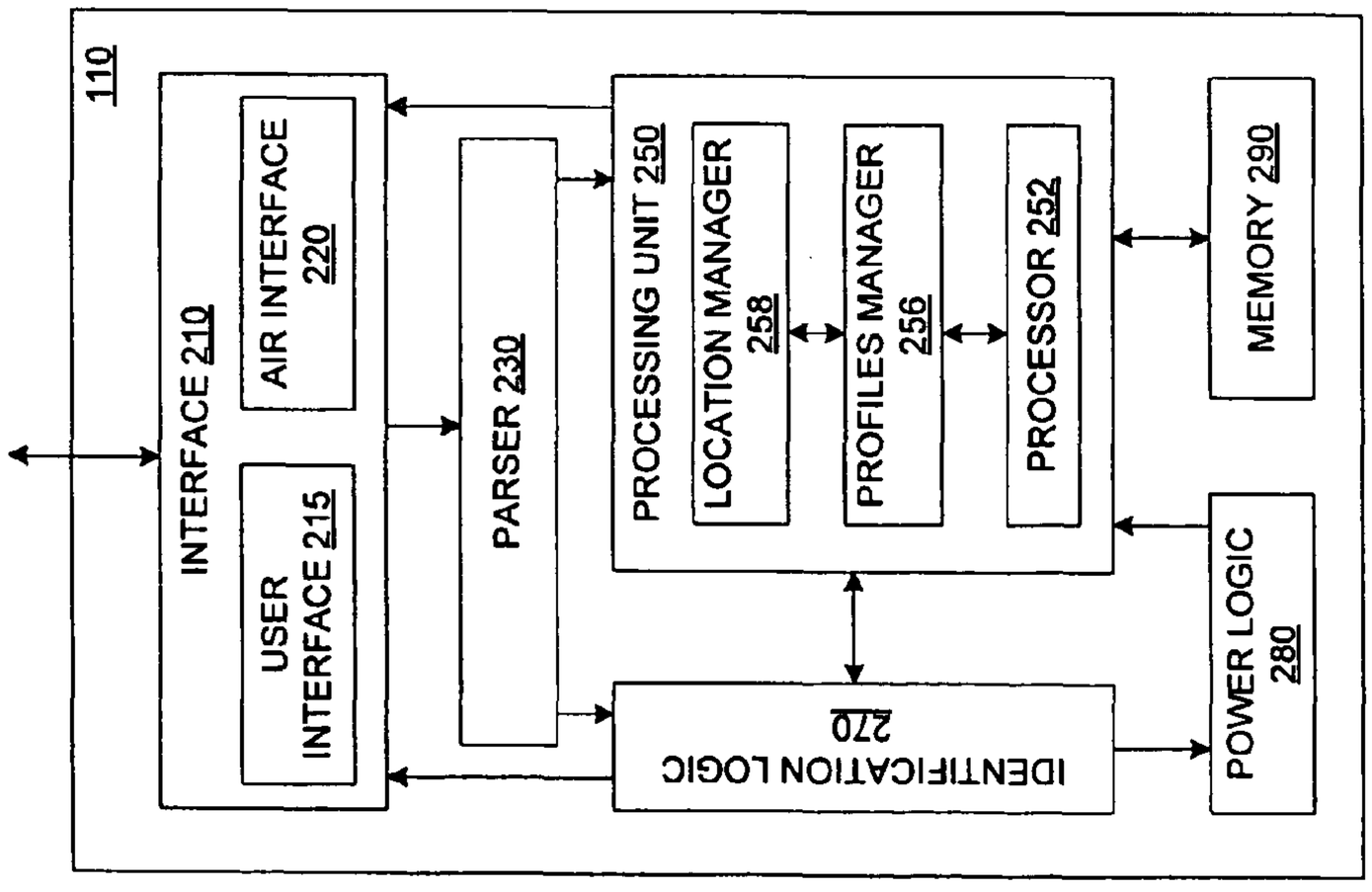

110
INTERFACE 210
AIR INTERFACE 220
USER INTERFACE 215
PARSER 230
PROCESSING UNIT 250
LOCATION MANAGER 258
PROFILES MANAGER 256
PROCESSOR 252
IDENTIFICATION LOGIC 270
MEMORY 290
POWER LOGIC 280

FIG. 2

# IDENTIFYING THE LOCATION OF MOBILE STATIONS

## BACKGROUND

A mobile network may comprise a plurality of mobile stations ('cell phones) used by the users to communicate. For example, a first user may communicate with a second user using voice communication (speech) and text messaging (short message service, SMS) features supported by the cell phones. However, the users may lose their cell phones or forget the location in which the cell phone is placed. For example, the first user may call his/her cell phone and based on the ringing sound generated by the cell phone, the first user may determine the physical location of the cell phone. However, while the cell phone is lost, if the cell phone is 'turned-off' mode or 'silent mode', it may be difficult for the first user to determine the physical location of the cell phone.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention described herein is illustrated by way of example and not by way of limitation in the accompanying figures. For simplicity and clarity of illustration, elements illustrated in the figures are not necessarily drawn to scale. For example, the dimensions of some elements may be exaggerated relative to other elements for clarity. Further, where considered appropriate, reference labels have been repeated among the figures to indicate corresponding or analogous elements.

FIG. **1** illustrates a mobile network environment **100**, including one or more mobile stations, which support identifying location of the mobile stations according to one embodiment.

FIG. **2** is a block diagram of a mobile station supporting identification of the location of the mobile station in one embodiment.

FIG. **3** is a flow-chart illustrating the mobile station in which a identifying the location of the mobile station is performed according to one embodiment.

## DETAILED DESCRIPTION

The following description describes embodiments of a mobile station whose location can be identified, while it is lost in switched-off or silent mode. In the following description, numerous specific details such as logic implementations, resource partitioning, or sharing, or duplication implementations, types and interrelationships of system components, and logic partitioning or integration choices are set forth in order to provide a more thorough understanding of the present invention. It will be appreciated, however, by one skilled in the art that the invention may be practiced without such specific details. In other instances, control structures, gate level circuits, and full software instruction sequences have not been shown in detail in order not to obscure the invention. Those of ordinary skill in the art, with the included descriptions, will be able to implement appropriate functionality without undue experimentation.

References in the specification to "one embodiment", "an embodiment", "an example embodiment", indicate that the embodiment described may include a particular feature, structure, or characteristic, but every embodiment may not necessarily include the particular feature, structure, or characteristic. Moreover, such phrases are not necessarily referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with an embodiment, it is submitted that it is within the knowledge of one skilled in the art to affect such feature, structure, or characteristic in connection with other embodiments whether or not explicitly described.



Embodiments of the invention may be implemented in hardware, firmware, software, or any combination thereof. Embodiments of the invention may also be implemented as instructions stored on a machine-readable medium, which may be read and executed by one or more processors. A machine-readable medium may include any mechanism for storing or transmitting information in a form readable by a machine (e.g., a computing device).

For example, a machine-readable medium may include read only memory (ROM); random access memory (RAM); magnetic disk storage media; optical storage media; flash memory devices; electrical, optical, acoustical or other forms of propagated signals (e.g., carrier waves, infrared signals, and digital signals). Further, firmware, software, routines, and instructions may be described herein as performing certain actions. However, it should be appreciated that such descriptions are merely for convenience and that such actions in fact result from computing devices, processors, controllers, and other devices executing the firmware, software, routines, and instructions.

A mobile network environment **100** including one or more mobile stations, which may support identifying the location of the mobile stations in accordance with one embodiment is illustrated in FIG. **1**. In one embodiment, the mobile network **100** may comprise mobile stations (MS) **110-1** to **110**-K, base stations **130-1** and **130-2**, mobile switching stations (MSC) **150-1** and **150-2**, short message service centers (SMSC) **170-1** and **170-2**, and a network **190**.

In one embodiment, the mobile station (MS) **110-1** to **110**-K may support voice and text communication for the users of the mobile stations (MS) **110** to communicate with other users, even while the users are on the move. In one embodiment, the mobile stations (MS) **110** may include cell phones, laptop computers, personal digital assistants (PDAs), mobile internet devices (MIDs), and such other similar devices. In one embodiment, the user of the mobile station MS **110-2** may lose the mobile station MS **110-2**, while the mobile station MS **110-2** is in switched off or silent mode.

In one embodiment, the user may send a text message such as a 'Find-Me' message to the mobile station MS **110-2** using other mobile station MS **110**-K. In one embodiment, if the mobile station MS **110-2** is in switched-off mode, the MS **110-2**, in response to receiving the 'Find-Me' message, may power-on the components of the MS **110-2** such that the mobile station MS **110-2** may receive voice call and text messages. In one embodiment, the user of mobile station MS **110-2** may call-up the MS **110-2** using the mobile station MS **110**-K. In one embodiment, the user of the MS **110-2** may call-up the MS **110-2** after sending the 'Find-Me' message from the mobile station MS **110**-K. In one embodiment, the user of MS **110-2** may identify the location of the MS **110-2** by tracking the ringing sound of the mobile station MS **110-2**.

In one embodiment, if the mobile station MS **110-2** is in silent mode, the mobile station MS **110-2** may change the profile of the mobile station MS **110-2** from a silent mode to a regular-noisy mode. In one embodiment, the user may call the MS **110-2** after sending the 'Find-Me' message from the mobile station MS **110**-K and identify the location of the MS **110-2** by tracking the ringing sound of the MS **110-2**. In yet other embodiment, the MS **110-2** may send a location message to the mobile station MS **110**-K in response to receiving the 'Find-Me' message. In one embodiment, the location message sent by the mobile station MS **110-2** may include the

coordinate values, which may be used to identify the location of the mobile station MS **110-2**.

In one embodiment, the base station BS **130-1** may receive the voice and message data from the mobile stations MS **110** (e.g., **110**-K) and may send the data packets to the mobile switching center MSC **150-1**. In one embodiment, the base station **130-1** may also transmit packets to the MS **110** (e.g., MS **110-2**) that are received from the mobile stations such as MS **110**-K. In one embodiment, the base stations **130** may comprise transceivers for transmitting and receiving the data units. In one embodiment, the base stations **130** may support standards such as global system for mobile (GSM), general packet radio system (GPRS).

In one embodiment, the mobile switching center (MSC) **150** may handle voice calls, text messages (SMS message), and other data services such as conference calls and circuit switched data. In one embodiment, the MSC **150** may perform set-up and release end-to-end connection, handle mobility, hand-off requirements, and billing services. In one embodiment, the MSC **150-2** may receive the 'Find-Me' message from the base station **130-2** and may forward the 'Find-Me' message to the SMSC **170-2**.

In one embodiment, the short message servicing center (SMSC) **170** (e.g., SMSC **170-2**) may receive a text message such as the 'Find-Me' message from one mobile station **110** (e.g., MS **110**-K) and may forward the text message to other mobile station **110** (e.g., MS **110-2**) via the network **190**. In one embodiment, the SMSC **170** may store the incoming message and deliver the incoming message on to a destination mobile station while the destination mobile station is available. In one embodiment, the SMSC **170** may attempt a known number of times to deliver the message to the destination mobile station. In one embodiment, the SMSC **170** may include store-and-forward operation.

In one embodiment, the network **190** may comprise switches, routers, bridges, and such other similar devices to route the voice and data units from the sender to the receiver. In one embodiment, the network **190** may support wireless technologies such as IEEE® 802.11a, IEEE® 802.11g, WiMax, and such other similar wireless technologies. In one embodiment, the network **190** may receive the 'Find-Me' message forwarded by the SMSC **170-2** and may route the 'Find-Me' message to the SMSC **170-1**.

FIG. **2** illustrates a block diagram of a mobile station supporting identification of the location of the mobile station in one embodiment. In one embodiment, the mobile station MS **110-2** may comprise an interface **210**, a parser **230**, a processing unit **250**, an identification logic **270**, a power logic **280**, and a memory **290**.

In one embodiment, the interface **210** may comprise a user interface **215** and an air interface **220**. In one embodiment, the user interface **215** may comprise a key pad, microphone, camera, and such other similar devices, which may allow the user to send voice call and text messages. In one embodiment, user may use the key pad to key-in the message or call-up a number, which identifies the other mobile station **110**.

In one embodiment, the air interface **220** may be used to send and receive voice calls and messages between the mobile stations MS **110** over the air interface. In one embodiment, the air interface **220** may comprise antennas, signal conditioning, and such other units to support transfer of messages and voice calls between the mobile stations MS **110**. In one embodiment, the air interface **220** may receive the 'Find-Me' message and forward the 'Find-Me' message to the parser **230**. In response to forwarding the Find-me message, the air interface **220** may receive a 'location message' from the processing unit **250** and may forward the 'location message' over the air medium that may reach the mobile station from which the 'Find-Me' message was received.

In one embodiment, the parser **230** may check if a message received is a 'Find-Me' message and may forward the "Find-Me' message to the identification logic **270**. In one embodiment, the parser **230** may forward the message to the processing unit **250** if the message is not a 'Find-Me' message. In one embodiment, the parser **230** may parse the message to check the presence of the string "Find-Me".

In one embodiment, the processing unit **250** may comprise a processor **252**, a profiles manager **256**, and a location manager **258**. In one embodiment, the processor **252** may power-ON in response to receiving a 'power signal' from the power logic **280**. In one embodiment, the processor **252** may configure the profiles manager **256** in response to receiving a 'change profile' signal from the identification logic **280**. In one embodiment, the processor **252** may change the ring tone from silent, or meeting, or vibration mode to a regular-nosiy mode.

In one embodiment, the user of the mobile station **110-2** may have created one or more profiles and the processor **252** may instruct the profiles manager **256** by sending a 'select regular profile' signal. In one embodiment, the profiles manager **256** may deselect the 'silent', or 'meetings' profile and select a 'regular-noisy' profile in response to receiving the 'select regular profile' signal. In one embodiment, the ringing tone of the regular-noisy profile may be set equal to a noisy mode by the user before the mobile station MS **110-2** is lost. In one embodiment, the profiles, messages, and other software programs may be stored in the memory **290**.

In one embodiment, the processor **252** may receive coordinate values from which the location of the mobile station **110-2**. In one embodiment, the processor **252** may receive the coordinate values in response to sending a location retrieve signal to the location manager **258**. In one embodiment, the processor **252** may generate the location message and send the location message to the interface **210**. In one embodiment, the location manager **258** may be enabled with global positioning system (GPS) and the location manager **258** generate the coordinate values based on the data provided by the GPS system.

In one embodiment, the identification logic **270** may send a 'power-on' signal to the power logic **280** in response to receiving the 'Find-Me' message from the parser **230**. In one embodiment, the identification logic **270** may wait until the processing unit **250** is powered ON and may then send the 'change profile' signal to the processing unit **250**. In one embodiment, the identification logic **270** may wake-up from the sleep mode in response to receiving the "Find-Me" message and be in sleep-mode otherwise. Such an approach may conserve power.

In one embodiment, the power logic **280** may generate the 'power signal' in response to receiving the 'power-on' signal from the identification logic **270**. In one embodiment, the power logic **280** may send the 'power signal' to the processing unit **250**, which may switch on the power to the processing unit **250**.

FIG. **3** is a flow-chart illustrating the mobile station in which a identifying the location of the mobile station is performed according to one embodiment. In block **310**, the user of the first mobile station may determine if the first mobile station is lost while the MS **110-2** was in switch-OFF or silent mode. Control passes to block **315** if the first mobile station is not lost and to block **320** if the first mobile station is lost while the MS **110-2** was in switch-OFF or silent mode. In one

embodiment, the user of the mobile station MS **110-2** may determine if the MS **110-2** is lost while the MS **110-2** was in switch-OFF or silent mode.

In block **315**, the first mobile station MS **110-2** continues to operate in regular mode. In block **320**, the user may use a second mobile station MS **110**-K to send a "Find-Me" message to the first mobile station MS **110-2**.

In block **330**, the first mobile station MS **110-2** may receive the "Find-Me" message. In one embodiment, the air interface **220** may receive the "Find-Me" message and send the "Find-Me" message to the parser **230**, which in turn would parse the message and send the "Find-Me" message to the identification unit **270** on detecting the presence of the string "Find-Me" in the "Find-Me" message.

In block **340**, the identification logic **270** of the first mobile station MS **110-2** may determine if the mobile station MS **110-2** is in switched-OFF mode and control passes to block **350** if the identification logic **270** detects that the first mobile station MS **110-2** is in switched OFF mode and to block **360** if the first mobile station MS **110-2** is not in switch-OFF mode.

In block **350**, the identification logic **270** of the first mobile station MS **110-2** may initiate the power logic **280** to power on the processing unit **250**. In one embodiment, the identification logic **270** may send the 'power-on' signal to the power logic **280**. The power logic **280** may power-on the processing unit **250** in response to receiving the 'power signal' from the identification logic **270**.

In block **360**, the profiles manager **256** may change the profile of the first mobile station MS **110-2** from the silent or meeting mode to the regular noisy mode in response to receiving the 'select regular profile' signal from the processor **252**. In one embodiment, the processor **252** may generate the 'select regular profile' signal in response to receiving the 'change profile' signal from the identification logic **270**.

In block **370**, the location manager **258** may check if the first mobile station MS **110-2** is GPS enabled and control passes to block **380** if the first mobile station MS **110-2** is GPS enabled and the process ends otherwise.

In block **380**, the processor **252** may retrieve the location details from the location manager **258** and may generate the location message comprising the location details. In one embodiment, the processor **252** may send the location message to the second mobile station MS **110**-K.

Certain features of the invention have been described with reference to example embodiments. However, the description is not intended to be construed in a limiting sense. Various modifications of the example embodiments, as well as other embodiments of the invention, which are apparent to persons skilled in the art to which the invention pertains are deemed to lie within the spirit and scope of the invention.

What is claimed is:

**1**. A method comprising: receiving a text message in a first mobile station, wherein the text message is sent from a second mobile station, changing profile of the first mobile station to a regular mode, wherein changing profile to the regular mode is performed if the text message includes an identifiable string, and identifying the location of the first mobile station, wherein the location of the first mobile station is identified by tracking the ringing sound

generated by the first mobile station in response to receiving a voice call from the second mobile station,

generating a location message including location coordinates of the first mobile station in response to receiving the text message,

sending the location message to the second mobile station, and identifying the location of the first mobile station using the location coordinates included in the location message sent to the second mobile station.

**2**. The method of claim **1**, wherein the first mobile station is in a silent mode before receiving the text message.

**3**. The method of claim **1**, wherein the first mobile station is in a switched off mode before receiving the text message.

**4**. The method of claim **3**, wherein the profile of the first mobile station is changed to the regular mode after switching on the first mobile station.

**5**. The method of claim **1**, wherein the first mobile station is enabled with global positioning capability.

**6**. An apparatus comprising: a parser to forward the text message if the text message includes an identifiable string, wherein the text message is sent from a second mobile station, an identification logic coupled to the interface, wherein the identification logic is to generate a first signal if the first mobile station is in a silent mode, and a processing unit coupled to the identification logic, wherein the processing unit is to change profile of a first mobile station to a regular mode in response to receiving the first signal from the identification logic, a location manager coupled to the identification unit, wherein the location manager is to generate a location message including location coordinates of the first mobile station in response to receiving the text message, and the interface is to send the location message to the second mobile station, wherein the second mobile station is to identify the location of the first mobile station using the location coordinates.

**7**. The apparatus of claim **6** further comprises an interface coupled to the processing unit, wherein the interface is to generate a ringing sound in response to receiving a voice call from the second mobile station, wherein a user of the first mobile station is to identify the first mobile station by tracking the ringing sound.

**8**. The apparatus of claim **6**, wherein the first mobile station is in a silent mode before receiving the text message.

**9**. The apparatus of claim **6**, wherein the first mobile station is in a switched off mode before receiving the text message.

**10**. The apparatus of claim **9** further comprises a power logic coupled to the identification logic, wherein the power logic is to power-on the processing unit in response to receiving a second signal from the identification logic.

**11**. The apparatus of claim **9** further comprises a profiles manager coupled to the identification logic,

wherein profiles manager is to change the profile of the first mobile station to the regular mode after switching on the first mobile station,

wherein the profiles manager is to change the profile in response to receiving the first signal.

**12**. The apparatus of claim **6**, wherein the first mobile station is enabled with global positioning capability.

**13**. The apparatus of claim **6**, wherein the first mobile station is a cell phone.

**14**. The apparatus of claim **6**, wherein the first mobile is a wireless enabled laptop computer.

**15**. A system comprising: a first mobile station, and a second mobile station coupled to the first mobile station, wherein the first and the second mobile station is coupled through a wireless network, wherein the first mobile station is to receive a text message sent from a second mobile station, wherein the first mobile station is to change profile to a regular mode if the text message includes an identifiable string, and wherein a user is to identify the location of the first mobile station by tracking the ringing sound generated by the first mobile station in response to a voice call from the second mobile station, wherein the first mobile station is to, generate a location message including location coordinates of the first

mobile station in response to receiving the text message, and send the location message to the second mobile station, wherein the second mobile station is to identify the location of the first mobile station using the location coordinates.

**16**. The system of claim **15**, wherein the first mobile station is in a silent mode before receiving the text message.

**17**. The system of claim **15**, wherein the first mobile station is in a switched off mode before receiving the text message.

**18**. The system of claim **17**, wherein the profile of the first mobile station is changed to the regular mode after switching on the first mobile station.

**19**. The system of claim **15**, wherein the first mobile station is enabled with global positioning capability.

**20**. The system of claim **15**, wherein the first mobile station is a cell phone and the second mobile station is a wireless enabled laptop computer.

**21**. The system of claim **19**, wherein the first mobile station is a hand held device and the second device is a cell phone.

**22**. The system of claim **15** further comprises a short message service center,

wherein the short message service center is to receive the text message from the second mobile station and forward the text message to the first mobile station, and

wherein the short message service center is to receive the location message from the first mobile station and forward the location message to the second mobile station.

* * * * *